TITLE OF THE INVENTION

DATA TRANSMISSION SYSTEM

BACKGROUND OF THE INVENTION

5   Field of the Invention

The present invention relates to data transmission systems and, more specifically, to a data transmission system for transmitting data from a server to a data circuit terminating equipment that is connected to a data terminal equipment. Here,

10   the data that is transmitted from the server is the data that is reserved by the data terminal equipment.

Description of the Background Art

There have been proposed various data transmission

15   systems which are of a type as described above. An example is the data transmission system disclosed in Japanese Patent Laid-Open Publication No. 8-140081 (96-140081), which includes a device in an information source (hereinafter, referred to as server), and an information storage unit which receives the information on the

20   user's side. The server and the information storage unit are connected to each other over a network. The server waits for users' requests for data transmission until a data distribution time which has been set under a predetermined manner. Even if one request comes, the server waits for other requests for the transmission

25   of the same data for the set time period. When the data distribution

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time comes, the server sends the requested data onto a communications circuit. Then, the information storage unit on the user's side receives and stores the data therein. Accordingly, in such a conventional data transmission system, the server can

5   selectively perform data transmission in a time period when, before the data distribution time, the communications circuit is not congested. In this manner, the communications circuit can be efficiently utilized.

The issue here is that the communications circuit varies

10   in characteristics depending on its type. As an example, a wired public circuit typified by ISDN is not suited for multicasting. This is because any transmission bandwidth of a number of data channels in the public circuit is occupied by multicasting, thereby simultaneously transmitting the same data to many users using the

15   public communications circuit. Unlike the wired public circuit, a satellite circuit may be a possibility for multicasting since data transmission is performed through the shared use of a transmission bandwidth. However, the conventional data transmission system still bears a problem of not efficiently

20   utilizing the transmission bandwidth of the communications circuit since data is unconditionally sent out to the same communications circuit regardless of the number of users receiving the data. Here, assume that the data transmission system only has a wired public circuit. In such a case, a server in the system has to transmit

25   data through the wired public circuit regardless of whether

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multicasting is preferable, which results in a waste of transmission bandwidth.

The conventional data transmission system bears another problem regarding a communications expense. In a case where a user wants to download relatively large data such as moving pictures, the communications expense therefor is high.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a data transmission system which achieves an efficient use of a communications circuit in terms of transmission bandwidth, and data download from a server at a lesser expense.

The present invention has the following features to attain the object described above.

A first aspect of the present invention is directed to a data transmission system in which a server sends out, onto any one of a plurality of communications circuits, content data that is designated by a content reservation request to a data circuit terminating equipment connected to a data terminal equipment for storage.

The content reservation request additionally indicates a time limit in which the content data that is designated by the data terminal equipment is to be ready in the data circuit terminating equipment.

Either the server or any one of the communications

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circuits of the first aspect a time limit management part for managing the time limit that is designated by the content reservation request from the data terminal equipment; and a scheduling part for determining, based on both the time limit that

5   is managed in the time limit management part and predetermined communications information, a transmission timing which ensures that the content data completely transmitted by the time limit and an optimal communications circuit from among the plurality communications circuits.

10   Further, the server comprises a data send out part for sending out the content data onto the optimal communications circuit according to the transmission timing that is determined by the scheduling part.

        A second aspect of the present invention is directed

15   to a data transmission system in which content data that is designated by a content reservation request is transmitted from a server to a data terminal equipment through a communications circuit.

        The content reservation request additionally indicates

20   a download condition for downloading the content data that is designated by the data terminal equipment.

        The data transmission system of the second aspect comprises a content reservation status data generation part for generating content reservation status data indicating the

25   download condition for the content data based on the received

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content reservation request. The data transmission system of the second aspect also comprises

a data transmission part for transmitting the content reservation status data that is generated by the content reservation status data generation part to the data terminal equipment.

By comprising the content reservation status data generation part and the data transmission part, the transmission system induces other data terminal equipment by showing that the content data is available under the download condition.

The data transmission system of the second aspect further comprises: a DL condition management part for managing the content data and the download condition that is designated (indicated) by the content reservation request from the data terminal equipment; a scheduling part for determining, based on the download condition managed in the DL condition management part, a transmission timing which ensures that the content data is transmitted under the download condition; and a data send out part for sending out the content data onto the communications circuit according to the transmission timing that is determined by the scheduling part.

These and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

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FIG. 1 is a diagram showing the entire configuration of a data transmission system according to a first embodiment of the present invention;

FIG. 2 is a block diagram showing the configuration of a data circuit terminating equipment (DCE) 3 of FIG. 1:

FIG. 3 is a block diagram showing the configuration of a content server 6 of FIG. 1;

FIG. 4 is a diagram showing the configuration of a content data CD which is stored in a content storage 64 of FIG. 3;

FIG. 5 is a schematic diagram of an addressee list L_{DEST} which is stored in an addressee list storage 65 of FIG. 3;

FIG. 6 is a schematic diagram of a charge list L_{PAY} which is stored in a charge list storage 66 of FIG. 3;

FIG. 7 is a schematic diagram of a transmission expense list L_{TC} which is stored in a transmission expense list storage 67 of FIG. 3;

FIG. 8 is a schematic diagram of a transmission initial expense list L_{ITC} which is stored in a transmission initial expense list storage 68 of FIG. 3;

FIG. 9 is a first half of a sequence chart showing a communications procedure in the data transmission system of FIG. 1;

FIG. 10 is a second half of the sequence chart showing the communications procedure in the data transmission system of FIG. 1;

FIG. 11 is a flowchart showing step ST1 of FIG. 9 in more detail for its processing procedure;

FIG. 12 is a diagram for demonstrating the contents of content reservation status data D_{RS} of FIG. 9;

FIGS. 13a to 13g are diagrams for demonstrating the configuration of data and signals that are shown in both FIGS. 9 and 10;

FIG. 14 is a flowchart showing step ST13 of FIG. 9 in more detail for its processing procedure;

FIG. 15 is a flowchart showing step ST8 of FIG. 10 in more detail for its processing procedure;

FIGS. 16a to 16c are diagrams each showing a unit record UR_1 which is updated or newly-generated in step ST8 of FIG. 15;

FIG. 17 is a flowchart showing step ST9 of FIG. 10 in more detail for its processing procedure;

FIG. 18 is a flowchart showing step ST92 of FIG. 17 in more detail for its processing procedure;

FIGS. 19a and 19b are diagrams for demonstrating a communications circuit flag F_{CIR} that is set by the processing of FIG. 18;

FIGS. 20a and 20b are diagrams schematically showing the processing of steps ST94 to ST99 of FIG. 17;

FIG. 21 is a flowchart showing step ST10 of FIG. 10 in more detail for its processing procedure;

FIG. 22 is a flowchart showing step ST11 of FIG. 10 in

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more detail for its processing procedure;

FIGS. 23a to 23c are drawings demonstrating a content data set CDS according to a second embodiment of the present invention;

5   FIG. 24 is a block diagram showing the configuration of a DCE 3 in the second embodiment;

FIG. 25 is a first half of a sequence chart showing a communications procedure in a data transmission system of the second embodiment;

10   FIG. 26 is a second half of the sequence chart showing the communications procedure in the data transmission system of the second embodiment;

FIGS. 27a and 27b are diagrams demonstrating a selection condition list L_{SC} which is stored in a selection condition list

15   storage 36 of FIG. 24;

FIG. 28 is a flowchart showing step ST22 of FIG. 25 in more detail for its processing procedure;

FIG. 29 is a flowchart showing step ST11′ of FIG. 26 in more detail for its processing procedure;

20   FIG. 30 is a diagram showing an allocation list L_{ST} which is stored in an allocation list storage 37 of FIG. 24;

FIG. 31 is a flowchart showing step ST23 of FIG. 26 in more detail for its processing procedure;

FIG. 32 is a flowchart showing step ST14′ of FIG. 26

25   in more detail for its processing procedure;

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FIG. 33 is a diagram showing a specific example of a content data set which is stored in a content storage 35 of FIG. 24; and

FIG. 34 is a diagram showing a specific example of a content data CD that is sent out from a user interface 32 of FIG. 24.

DETAILED DESCRIPTION OF THE INVENTION

First Embodiment

FIG. 1 is a diagram showing the entire configuration of a data transmission system according to a first embodiment of the present invention. In FIG. 1, the data transmission system includes a data terminal equipment (hereinafter, referred to as DTE, two DTEs are illustrated herein) 1, a wired or wireless transmission path 2, a data circuit terminating equipment (hereinafter, referred to as DCE) 3, a first and a second communications circuit 4 and 5 which are exemplified herein as a plurality of communications circuits, and a content server (hereinafter, simply referred to as server) 6.

The DTE 1 is operable by a user as is a personal computer, and carries out output processing on a content data CD (see FIG. 4) that is downloaded from the server 6 so as to output to the user what the content data CD presents. The DTE 1 is connected to the DCE 3 through the transmission path 2 for bidirectional data communications therebetween.

The DCE 3 is connected to at least one exchange system 41 (as will be described later), and performs bidirectional data communications with the server 6 through the first communications circuit 4. In the DCE 3, power is supplied for operation,

5   preferably, from the first communications circuit 4, which is wired. The DCE 3 is also connected to a reception antenna 53 (as will be described below), and receives data from the server 6 through the second communications circuit 5. The DCE 3 includes, as shown in FIG. 2, a processing unit 31, a user interface 32, a circuit

10   interface 33, a reception unit 34, and a content storage 35.

The DTE 1 and DCE 3 are placed on the user's side (typically in the user's house) as shown in FIG. 1. Here, the DTE 1 may be plurally provided. FIG. 1 shows a set thereof only for one user for convenience, but the actual data transmission system of the

15   first embodiment includes many sets of equipment, which are at least one DTE 1 and the DCE 3, on the user side. Each of the equipment that is provided on the user's side is assigned, in advance, a unique identifier ID_{USER} for user identification. In the first embodiment, the identifier ID_{USER} that is assigned to the set of

20   the DTEs 1 and the DCE 3 of FIG. 1 is presumably α_1.

The first communications circuit 4 is a wired public circuit having several exchange systems 41 provided therein. These exchange systems 41 are connected to one another via a communications line that is typified by an optical fiber cable,

25   a twisted pair wire, and/or a coaxial cable. The first

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communications circuit 4 is suited for transmitting each different

content data CD to many DTEs 1 due to the exchange systems 41 each

performing routing. However, the first communications circuit

4 is not suited for multicasting. This is because if the server

5   6 simultaneously distributes the same content data CD to many DTEs

1 over the first communications circuit 4, any transmission

bandwidth of a number of data channels is occupied by data

distribution.

    The second communications circuit 5 includes, in the

10   first embodiment, a transmission antenna 51, and a satellite

circuit including an artificial satellite 52 and the reception

antenna 53. Unlike the first communications circuit 4, however,

the second communications circuit 5 is suitable for multicasting

and allows a shared use of a bandwidth for the transmission of

15   the same content data CD to many DTEs 1. However, the second

communications circuit 5 is not good for transmitting each

different content data CD to many DTEs 1 as the transmission

bandwidth of the second communication circuit 5 is sharable by

all of the plurality of DTEs 1. If various content data CDs are

20   sent out onto the second communications circuit 5, it will soon

be short of the transmission bandwidth. Here, as shown in FIG.

1, the DCE 3, and the first and second communications circuits

4 and 5 configure a data transmission network 7.

    The server 6 is placed on the information provider's

25   side from where the content data CD is distributed to the users',

side and is previously assigned a unique identifier ID_{SERVER} for

server identification. The server 6 is connected to at least one

exchange system 41, and performs bidirectional data communications

with the DCE 3 through the first communications circuit 4. The

5   server 6 is also connected to the transmission antenna 51, and

transmits data to the DTE 1 over the second transmission circuit

5. As shown in FIG. 3, the server 6 includes a processing unit

61, a circuit interface 62, a transmission unit 63, a content storage

64, an addressee list storage 65, a charge list storage 66, a

10   transmission expense list storage 67, and a transmission initial

expense list storage 68.

As shown in FIG. 4, the content storage 64 stores several

types of content data CDs. The content data CD is typically moving

picture data, static picture data, audio data, object data,

15   character data, or a combination of two or more of such data. Also,

the content data CD is provided with at least an identifier ID_{CD}

and a data size I_{DS}. The identifier ID_{CD} uniquely specifies a

recording location where the content data CD is stored in the content

storage 64. The data size I_{DS} shows the content data CD by size.

20   In the first embodiment, as shown by the accompanying drawings,

content data CD_A and CD_B are stored in the content storage 64. Here,

presumably, the content data CD_A is provided with β_1 for the

identifier ID_{CD} and γ_1 for the data size I_{DS}, while the content

data CD_B is provided with β_2 and γ_2 for the identifier ID_{CD} and

25   the data size I_{DS}, respectively.

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The addressee list storage 65 corresponds to a time limit management part and a DL condition management part herein, and stores an addressee list L_{DEST} therein. As shown in FIG. 5, the addressee list L_{DEST} is composed of several unit records UR_1, which

5   are exemplarily described herein as UR_{11} to UR_{13}. Each unit record UR_1 indicates what the conditions are for downloading the content data CD therein. Specifically, included in each of the unit records UR_1 are a download condition number (hereinafter, referred to as DL condition number) N_{DL}, an identifier ID_{CD}, a time limit LT, a

10   transmission expense TC, at least one identifier ID_{USER}, and a communications circuit flag F_{CIR}. Herein, the DL condition number N_{DL} uniquely specifies the unit record UR_1, and the identifier ID_{CD} specifies which content data CD corresponds to a user's request for data transmission. The time limit LT is a user designated

15   time for the content data CD at the user's request to be ready in the content storage 35 of the DCE 3. The identifier ID_{USER} shows, specifically in the addressee list L_{DEST}, the DCE 3 which receives the content data CD. The transmission expense TC indicates how much the user is to be charged for the content data CD that is

20   transmitted from the server 6 to the DCE 3. The communications circuit flag F_{CIR} indicates which of the communications circuits 4 or 5 is to be used for the transmission of the content data CD. In the first embodiment, presumably, a value of 1 for the communications circuit flag F_{CIR} indicates the first communications

25   circuit 4, while a value of 0 for the communication circuit flag

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F_{CIR} indicates the second communications circuit 5 (refer to FIGS. 19a and 19b).

In this example of FIG. 5, specifically, the unit record UR_{11} shows β_1 for the identifier ID_{CD}, 18:00 on February 17 for the time limit LT, and α_2 to α_{500} for the identifier ID_{USER}. Here, α_2 to α_{500} mean 499 sets of equipment, which are exclusive of the set α_1 in FIG. 1. Accordingly, the content data CD_A is transmitted, by 18:00 on February 17, to 499 DCEs 3 that are specified by the identifier ID_{USER}. Further, the unit record UR_{11} shows ¥450 for the transmission expense TC, which means the current transmission expense of the content data CD_A for those 499 DCEs is ¥450. Here, the unit records UR_{12} and UR_{13} are not described as they are similar to the unit record UR_{11}. Note that the unit records UR_1 which are exemplified herein show only the identifier ID_{CD} of β_1, which means that no user is requesting for the transmission of the content data CD_B.

The charge list storage 66 stores a charge list L_{PAY}. As shown in FIG. 6, the charge list L_{PAY} is composed of charge information I_{PAY} for every identifier ID_{USER}. The charge information I_{PAY} indicates how much a user that is specified by the corresponding identifier ID_{USER} needs to pay, in total, for the content data CD(s) that the user downloaded in a predetermined time period. Note herein that, for easy understanding, the charge information I_{PAY} presumably indicates the total amount of the transmission expense TC. This is not restrictive, and other types

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of expenses (i.e., a copyright fee) may be included therein.

The charge list L_{PAY} in FIG. 6 exemplifies a case where the identifier ID_{USER} is α_1, and the charge information I_{PAY} therefor is ¥1,500. Cases for other identifier ID_{USER} are not described here for the sake of convenience.

The transmission expense list storage 67 stores a transmission expense list L_{TC}. As shown in FIG. 7, the transmission expense list L_{TC} indicates that the transmission expense TC varies with the number of users N_{USER} that request data transmission. In the first embodiment, the number of users N_{USER} is put into 5 classes of N_{USER1} to N_{USER5}, depending on the number of users. As an example, the number of users N_{USER1} covers a range of 1 to 19 users , and the transmission expense TC therefor is fixed at ¥550. FIG. 7 illustrates an example the respective transmission expenses TC for other classes of the number of users N_{USER2} to N_{USER5}.

The transmission initial expense list storage 68 stores a transmission initial list L_{ITC}, which shows the transmission expense TC in its initial value. As shown in FIG. 8, the transmission initial expense list L_{ITC} shows that the transmission initial expense varies with a time margin TM, which is a length of time that is measured from the server 6 receiving a user's content reservation request RS_{TR} to the time limit LT designated thereby. In the first embodiment, the time margin TM is put into 5 classes of TM_1 to TM_5, depending on the amount of the time margin TM. For example, the time margin TM_1 covers a range of 0 to 12 (hour),

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and the transmission initial expense ITC_1 therefor is fixed at
¥550. FIG. 8 illustrates an example of the respective transmission
initial expenses ITC for other classes of the time margins TM_2
to TM_5.

5   Described next with reference to the sequence charts
of FIGS. 9 and 10 is the communications procedure for the DTE 1
to retrieve a content data CD in the above-structured data
transmission system. First, in FIG. 9, in response to a request
coming from the DTE 1 (not shown), the server 6 generates content

10   reservation status data D_{RS} based on an addressee list L_{DEST} that
is currently stored (step ST1). Step ST1 corresponds to a content
reservation status data generation part herein, and FIG. 11 shows
the processing procedure thereof in detail. In FIG. 11, the
processing unit 61 of the server 6 extracts, from each unit record

15   UR_1 that is found in the addressee list L_{DEST} (see FIG. 5), a DL
condition number N_{DL}, a time limit LT, and a transmission expense
TC (step ST110). Next, the processing unit 61 generates a download
condition list (hereinafter, referred to as a DL condition list)
L_{DL} for every extracted set of the DL condition number N_{DL}, the

20   time limit LT, and the transmission expense TC (step ST120). The
DL condition list specifies what are the conditions for downloading
any content data CD.

          After step ST120, the processing unit 61 generates
content reservation status data D_{RS} (step ST130). As shown in FIG.

25   12, the content reservation status data D_{RS} represents each DL

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condition list L_{DL} that is generated in step S120 and displayed

on the side of DTE 1. With this DL condition list L_{DL}, the user

can easily find the DL condition list L_{DL} that best meets his/her

needs. Here, the content reservation status data D_{RS} is generated

5   in such a manner that the DTE 1 can generate a content reservation

request RS_{TR}, which will be described later, in response to the

user's designation of the DL condition number N_{DL}. Preparing for

a case where the user does not find a DL condition list L_{DL} matching

his/her needs, the content reservation status data D_{RS} is structured

10   so that the user himself/herself can designate the content data

CD and the time limit LT by operating the DTE 1. This is the end

of the processing of step ST1.

Here, assume that the processing unit 61 generates such

content reservation status data D_{RS} based on the unit records UR_{11}

15   to UR_{13} shown in FIG. 5. In this case, after the DTE 1 executes

display processing on the content reservation status data D_{RS},

three DL condition lists L_{DL1} to L_{DL3} as shown in FIG. 12 are displayed

on a screen of the DTE 1. Here, the DL condition list L_{DL1} for

the content data CD_A indicates 18:00 on February 17 for the time

20   limit LT, and ¥450 for the transmission expense TC. Here, the

DL condition list DL_2 and DL_3 are not described as they are similar

to the DL condition list DL_1. Note that the unit records UR_1 which

are exemplified herein do not show the identifier ID_{CD} of β_2, which

means the content reservation status data D_{RS} does not include

25   any DL condition list L_{DL} for the content data CD_B.

Such content reservation status data D_{RS} is forwarded from the processing unit 61 to the circuit interface 62 so as to be converted into a format which is suitable for the first communications circuit 4. Then, the format-converted data D_{RS} is sent out onto the first communications circuit 4. The circuit interface 62 corresponds to a data transmission part herein. The content reservation status data D_{RS} is received by the circuit interface 33 of the DCE 3 after going through several exchange systems 41 in the first communications circuit 4. By the circuit interface 33, the content reservation status data D_{RS} is converted back (reconverted) into its original format before being forwarded to the user interface 32 via the processing unit 31. Then, the user interface 32 converts the received content reservation status data D_{RS} before being sent out onto the transmission path 2 into a format that is suited therefor. The content reservation status data D_{RS} is then received by the DTE 1 (sequence SQ1).

In response to the content reservation status data D_{RS}, the DTE 1 generates a request (step ST2). Specifically, the DTE 1 reconverts the received content reservation status data D_{RS} into its original format, and then displays each of the DL condition list L_{DL}, and the like, on the screen of the DTE 1 with the output processing having been executed (see FIG. 12). Thereby, the user can search for any DL condition list L_{DL} whose time limit LT and transmission expense TC meet his/her needs while referring to the reservation status of each content data CD. If the user finds

any suitable DL condition list L_{DL}, the user designates the DL condition number N_{DL} thereof. In response, the DTE 1 generates a content reservation request RS_{TR} such as the one shown in FIG. 13a. In FIG. 13a, the content reservation request RS_{TR} is a signal which indicates that the user wants any specific content data CD to be transmitted for downloading, and includes at least an identifier ID_{TR}, an identifier ID_{SERVER}, an identifier ID_{USER}, and a DL condition number N_{DL}. Here, the identifier ID_{TR} is the identifier which specifies that the signal is a content reservation request RS_{TR}. The identifier ID_{SERVER} specifies which server 6 is the addressee of the content reservation request RS_{TR}, while the identifier ID_{USER} specifies from where the content reservation request RS_{TR} came (i.e., DTE 1). Here, since the DL condition number N_{DL} is the one that is designated by the user, the server 6 can know which content data CD is requested together with the time limit LT and the transmission expense TC thereof.

In the case when the user does not find any DL condition list L_{DL} matching his/her needs, the user operates the DTE 1 to designate any specific content data CD and time limit LT. In response, the DTE 1 generates a content reservation request RS_{TR} such as the one shown in FIG. 13b. As compared to the content reservation request RS_{TR} of FIG. 13a, the content reservation request RS_{TR} of FIG. 13b carries the identifier ID_{CD} and the time limit LT instead of the DL condition number N_{DL}.

Such a content reservation request RS_{TR} in the DTE 1

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is converted into a format that is suitable for the transmission path 2, and is then sent out on the transmission path 2 to be received by the user interface 32 of the DCE 3 (see FIG. 2). The, the content reservation request RS_{TR} is reconverted in the user interface 32 before being forwarded to the circuit interface 33 via the processing unit 31. In the circuit interface 33, the received content reservation request RS_{TR} is converted into a format that is suitable for the first communications circuit 4, and is then sent out onto the first communications circuit 4. The content reservation request RS_{TR} is then received by the circuit interface 62 of the server 6 (see FIG. 3)(sequence SQ2). In the circuit interface 62, the content reservation request RS_{TR} is reconverted and is forwarded to a memory (not shown) of the processing unit 61.

The processing unit 61 checks the identifier ID_{TR} in the stored data so as to determine whether the stored data is the content reservation request RS_{TR}. The processing unit 61 also determines whether or not the time limit LT in the content reservation request RS_{TR} is still valid for transmitting the designated content data CD to the DTE 1 (step ST3). Here, refer to FIG. 14 for the detailed processing procedure of step ST3. In FIG. 14, the processing unit 61 of the server 6 sees whether the time limit LT in the content reservation request RS_{TR} has already passed or not (step ST31). If the time limit LT has not yet passed, the processing unit 61 generates a recording area reserve request

RS_{ER} such as the one shown in FIG. 13c (step ST32). In FIG. 13c, the recording area reserve request RS_{ER} is a signal indicating that a recording area in the content storage 35 of the DCE 3(see FIG. 2) is requested to be reserved. Here, the recording area

5 reserve request RS_{ER} includes at least an identifier ID_{RER}, an identifier ID_{USER}, and a data size I_{DS}. The identifier ID_{RER} specifies the received signal as a recording area reserve request RS_{ER}. The identifier ID_{USER} indicates which DCE 3 shall reserve a recording area, and the DCE 3 designated here is the same as the DCE 3 that

10 is set in the content reservation request RS_{TR}. The data size I_{DS} shows the content data CD that is designated by the content reservation request RS_{TR} by size, and is acquired by the processing unit 61 from the content storage 64 by using the identifier ID_{CD}. As for the identifier ID_{CD}, if the content reservation request

15 RS_{TR} is analyzed as being in the format of FIG. 13a, the DL condition number N_{DL} therein is referred to and the corresponding identifier ID_{CD} is extracted from the addressee list L_{DEST} (see FIG. 5). On the other hand, if the content reservation request RS_{TR} is in the format of FIG. 13b, the identifier ID_{CD} is extracted directly

20 therefrom. With the acquired identifier ID_{ER}, identifier ID_{USER} and data size I_{DS}, the processing unit 61 generates the recording area reserve request RS_{ER}.

The recording area reserve request RS_{ER} is then forwarded from the processing unit 61 to the circuit interface 62, and is

25 sent out onto a control channel of the first communications circuit

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4 (sequence SQ3). Here, the control channel is the one that is provided in advance to control the equipment (e.g., exchange system 41, DCE 3) in the first communications circuit 4. Note that in order to transmit data that was most recently received by the DTE

5 1 such as the content reservation status data D_{RS} a data channel of the first communications circuit 4 is used instead of the control channel. The recording area reserve request RS_{ER} goes through several exchange systems 41 before being received by any one predetermined exchange system 41. The predetermined exchange

10 system 41 typically is the one that is located closest to the DCE 3.

In response to the recording area reserve request RS_{ER}, the predetermined exchange system 41 generates a recording area reserve instruction IS_{ER} (step ST4). The recording area reserve

15 instruction IS_{ER} is a signal which instructs the DCE 3 to reserve a recording area, and includes at least, as shown in FIG. 13d, an identifier ID_{IER}, an identifier ID_{USER}, and a data size I_{DS}. Here, the identifier ID_{USER} and the data size I_{DS} are the same as those in the presently received recording area reserve request RS_{ER}.

20 The identifier ID_{IER} specifies itself as a recording area reserve instruction IS_{ER}. The generated recording area reserve instruction IS_{ER} goes through the predetermined exchange system 41 to the DCE 3, specifically to the circuit interface 33 (see FIG. 2) via the control channel of the first communications circuit

25 4 (sequence SQ4). Note that, in step ST4, the predetermined

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exchange system 41 operates as a recording area management unit herein.

With the reconversion processing that is executed on the recording area reserve instruction IS_{ER}, the circuit interface 33 of the DCE 3 forwards the reconverted recording area reserve instruction IS_{ER} to the processing unit 31. In response thereto, the processing unit 31 has the content storage 35 reserve a recording area that is large enough for the data size I_{DS} that is designated thereby (step ST5). With the recording area successfully reserved, the processing unit 31 generates a positive acknowledgement AS_{RD}. The positive acknowledgement AS_{RD} is a signal indicating that the recording area has been reserved, and, as shown in FIG. 13e, includes at least an identifier ID_{RD} for identifying the received signal as a positive acknowledgement AS_{RD}, an identifier ID_{USER} for specifying from where the positive acknowledgement AS_{RD} came, and an identifier ID_{SERVER} specifying an addressee thereof (i.e., the server 6). Such a positive acknowledgement AS_{RD} is sent out onto the control channel of the first communications circuit 4 via the circuit interface 33. Then, the positive acknowledgement AS_{RD} is received by the circuit interface 62 of the server 6 (see FIG. 3) via the first communications circuit 4 (sequence SQ5).

With the reconversion processing that is executed on the positive acknowledgement AS_{RD}, the circuit interface 62 forwards the positive acknowledgement AS_{RD} to the processing unit 61. In response thereto, the processing unit 61 generates a

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reception completion notice AS_{RR} (step ST6). The reception completion notice AS_{RR} is a signal notifying the DTE 1 that the content reservation request RS_{TR} has been successfully received, and, as shown in FIG. 13f, includes at least an identifier ID_{RR}, an identifier ID_{USER}, and an identifier ID_{SERVER}. The identifier ID_{RR} specifies the received signal as a reception completion notice AS_{RR}. The identifier ID_{USER} specifies which DTE 1 is to receive the reception completion notice AS_{RR}, while the identifier ID_{SERVER} specifies from which server 6 the reception completion notice AS_{RR} came. The reception completion notice AS_{RR} is also subjected to the conversion processing by the circuit interface 62 as is the content reservation status data D_{RS}, and is then sent out onto the first communications circuit 4 (sequence SQ6). Then, the reception completion notice AS_{RR} is processed in the same manner as the content reservation status data D_{RS} by the DCE 3, is transmitted over the transmission path 2, and is then received by the DTE 1.

In response to the reception completion notice AS_{RR}, the DTE 1 carries out reception completion output processing (step ST7). In detail, the DTE 1 shows the user, on its screen, a message indicating that the content reservation request RS_{TR} that was transmitted in step ST2 has been normally processed in steps ST3 and ST6 by the server 6.

If the processing in steps ST3 and ST6 is not normally completed for some reason, although not shown in FIG. 9, the

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processing unit 61 generates a failure notice if it is determined, in step ST31, that the time limit LT of the content reservation request RS_{TR} has already passed (FIG. 14; step ST33). The processing unit 61 generates the failure notice also responding to a negative acknowledgement from the DCE 3. The negative acknowledgement is generated if a reservation for the recording area was not successful, and the negative acknowledgment is transmitted to the server 6 in the same manner as the positive acknowledgement AS_{RD}. The generated failure notice goes through, as the reception completion notice AS_{RR}, the first communications circuit 4, the DCE 3, and the transmission path 2, and is then received by the DTE 1. Upon reception of the failure notice, the DTE 1 shows the user, on its screen, a message indicating that the currently transmitted content reservation request RS_{TR} has failed to be normally processed in steps ST3 and ST6 by the server 6.

As for the above-described sequences SQ1 to SQ6, note that each downlink signal, which are the content reservation status data D_{RS}, the recording area reserve request RS_{ER}, the recording area reserve instruction IS_{ER}, and the reception completion notice AS_{RR}, is transmitted over the first communications circuit 4. The first embodiment, however, is not restricted thereto, and it is also possible to transmit each downlink signal over the second communications circuit 5 instead, but the first communications circuit 4 is still preferable here as the downlink signals are

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not multicast.

With step ST7 completed, FIG. 10 is now referred to for its sequence chart. In FIG. 10, the processing unit 61 carries out request acceptance processing (step ST8). Step ST8 corresponds to an acceptance processing part herein, and FIG. 15 shows the detailed processing procedure thereof. In FIG. 15, the processing unit 61 of the server 6 first determines whether the currently received content reservation request RS_{TR} carries any DL condition number N_{DL} (step ST81). If the currently received content reservation request RS_{TR} carries a DL condition number N_{DL} (see FIG. 13a), the processing unit 61 extracts, from the addressee list L_{DEST}, any unit record UR_1 corresponding to the DL condition number N_{DL} on the memory thereof (step ST82). Then, the processing unit 61 extracts the identifier ID_{USER} from the content reservation request RS_{TR}, adds the extracted identifier ID_{USER} to the unit record UR_1 on the memory, and then counts the total number of the identifiers ID_{USER} therein (that is, the number of users N_{USER} that are requesting the same content data CD) (step ST83).

Then, the processing unit 61 extracts, from the transmission expense list L_{TC} (see FIG. 7), the transmission expense TC corresponding to the counted number of users N_{USER} (step ST84). Here, to avoid confusion, the transmission expense TC which is found in the unit record UR_1 and which is retrieved in step ST82 is now referred to as a current transmission expense TC, while the transmission expense TC which is found in the transmission

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expense list L_{TC} in step ST84 is referred to as a new transmission expense TC.

The processing unit 61 then compares the new transmission expense TC with the current transmission expense TC to see which is more expensive (step ST85). If the current transmission expense TC is equal to or cheaper than the new transmission expense TC, the procedure skips step ST86 and goes to step ST87; otherwise the procedure goes through step ST86. That is, if the new transmission expense TC is cheaper than the current transmission expense TC, the processing unit 61 considers the new transmission expense to be good for the user and thus overwrites the current transmission expense TC of the unit record UR_1 on the memory (step ST86) with the new transmission expense TC. Then, the procedure goes to step ST87. In step ST87, the processing unit 61 stores the unit record UR_1 on the memory in the addressee list storage 65 so as to update the addressee list L_{DEST} therein. After step ST87 is completed, the processing unit 61 ends the processing of FIG. 15.

Hereinafter, the update processing (steps ST82 to ST86) that is executed on the unit record UR_1 is specifically described. Assume now that is the time to start the processing in step ST81, and a currently received content reservation request RS_{TR} shows 1 for the DL condition number N_{DL} and α_1 for the identifier ID_{USER}. Further, extracted in step ST82 the unit record UR_{11} shown in FIG. 5 is presumably extracted in step ST82. In such a case, after

step ST83, the unit record UR_{11} will include α_1 in the identifier ID_{USER} as shown in FIG. 16a, and the number of identifier ID_{USER} becomes 500 in total. Therefore, according to the transmission expense list L_{TC} of FIG. 7, the transmission expense TC of ¥400 is extracted in step ST84. Accordingly, after step ST86, as shown in FIG. 16b, the unit record UR_{11} shows ¥400 for the transmission expense TC.

As another example, the number of identifier ID_{USER} and the transmission expense TC in the unit record UR_{11} is presumably 10 and ¥550 when step ST81 is started, but the rest remains the same as in the above example. In this case, the new transmission expense TC (¥550) shows no change from the current transmission expense TC (¥550). Only a difference herein is α_1 added in the unit record UR_{11}.

As is known from the above, in the request acceptance processing, the more users that request for data transmission under the same conditions (e.g., time limit LT, content data CD), the cheaper the transmission expense TC becomes.

In step ST81 of FIG. 15, if the content reservation request RS_{TR} does not carry a DL condition number N_{DL} (see FIG. 13b), the processing unit 61 generates a new unit record UR_1. For this purpose, the processing unit 61 assigns a unique DL condition number N_{DL} to the to-be-generated new unit record UR_1, and then extracts identifier ID_{CD}, identifier ID_{USER}, and a time limit LT from the content reservation request RS_{TR} (step ST88). The

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processing unit 61 then calculates a difference, i.e., a time margin TM, between the time limit LT and the current time. Then, the processing unit 61 refers to the initial transmission expense list L_{TC} (FIG. 8) to see which transmission initial expense ITC therein

5   corresponds to the calculated time margin TM (step ST89). The found transmission initial expense ITC is extracted and is then written into the to-be-generated unit record UR_1. With the extracted information including the DL condition number N_{DL}, the identifier ID_{CD}, the time limit LT, the transmission expense TC,

10   and the identifier ID_{USER}, a new unit record UR_1 is generated (step ST810). Then, the processing unit 61 stores the generated unit record UR_1 in the addressee list storage 65 so as to update the addressee list L_{DEST} therein (step ST811). After step ST87 is completed, the processing unit 61 ends the processing of FIG. 15.

15   Hereinafter, the processing of adding a new unit record UR_1 (steps ST88 to ST811) is specifically described. Assume now that is the time to start the processing in step ST81, and that the addressee list L_{DEST} that is referred to is the one in FIG. 5. Also, the currently received content reservation request RS_{TR}

20   presumably shows β_1 for the identifier ID_{CD}, α_1 for the identifier ID_{USER}, 20:00 on February 15 for the time limit LT, and the current time is 20:00 on February 14. In this case, a time margin TM is 24 hours, and a transmission initial expense ITC to be retrieved in step ST89 is accordingly ¥480. Therefore, after step ST811

25   is completed, the addressee list L_{DEST} additionally includes the

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new unit record UR_{14} such as the one as shown in FIG. 16c.

As is known from the above, in the processing of adding a new unit record, the longer the time margin TM is before the time limit LT in the content reservation request RS_{TR}, the transmission initial expense ITC will be set to be cheaper. It is to be understood that the longer time margin TM leads the server 6 to accept more content reservation requests RS_{TR} requesting for the transmission of the same content data CD under the same conditions.

As shown in FIG. 10, the processing unit 61 of the server 6 carries out scheduling so as to determine a timing for transmitting the content data CD (step ST9). Although such scheduling is presumed here to be carried out only after the addressee list L_{DEST} is updated in step ST8, the first embodiment is not restricted thereto, and the scheduling may also be carried out within a predetermined interval. Step ST9 corresponds to a scheduling part herein, and FIG. 17 shows the detailed processing procedure thereof. In FIG. 17, the processing unit 61 searches the addressee list L_{DEST} (see FIG. 5) for unit records UR_1 satisfying a first condition of "time limit LT – current time < reference time RT" (step ST91). Here, the reference time RT is a predetermined time allowance plus a time which ensures that the data transmission from the server 6 to the DCE 3 is completed by the time limit LT, and the reference time RT is set in advance with consideration of parameters that are typified by the transmission bandwidth of the first and second

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communications circuits 4 and 5. Hereinafter, unit records UR_1

satisfying the first condition are referred to as a first group.

For each unit record UR_1 that is included in the first

group, the processing unit 61 then determines which communications

5   circuit 4 or 5 is to be used for data transmission (step ST92).

See FIG. 18 for the detailed processing procedure thereof. In

FIG. 18, the processing unit 61 selects one target unit record

UR_1 from the first group (step ST921). Then, the processing unit

61 determines whether the number of users N_{USER} in the selected

10   target unit record UR_1 exceeds a reference value V_{REF1} (step ST922).

The reference value V_{REF1} is a threshold for the number of users

requesting for the content data CD to be downloaded under the

conditions in the unit record UR_1, and the reference value V_{REF1}

is set in advance with consideration of parameters regarding the

15   first and second communications circuits 4 and 5 in terms of their

respective transmission bandwidths.

As described above, the second communications circuit

5 (satellite circuit) is suited for multicasting, and when the

number of users is quite large for data transmission, the second

20   communications circuit 5 is a better selection in view of the

transmission expense. Therefore, when the number of users N_{USER}

exceeds the reference value V_{REF1}, the processing unit 61 determines

that the second communication circuit 5 is suitable for the

transmission of the content data CD that is designated by the target

25   unit record UR_1. For example, assuming that the reference value

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V_{REF1} is now 499, as exemplified in FIG. 19a, the processing unit 61 sets 0 to the communications circuit flag F_{CIR} in the unit record UR_1 (step ST923).

On the other hand, when the number of users N_{USER} does not exceed the reference value V_{REF1} in step ST922, the processing unit 61 then uses a reference value V_{REF2} to compare with the number of users N_{USER} (step ST924). The reference value V_{REF2} is also a threshold, and is set to be, at least, smaller than the reference value V_{REF1}.

As already described, the first communications circuit 4 (public circuit) is not suited for multicasting, but is better for transmitting the same data to the fewer DTEs 1 (i.e., users) in view of the transmission expense per bit. Therefore, when the number of users N_{USER} does not exceed the reference value V_{REF2}, the processing unit 61 determines that the first communication circuit 4 is suitable for the transmission of the content data CD that is designated by the target unit record UR_1. Then, as exemplified in FIG. 19b, the processing unit 61 sets 1 to the communications circuit flag F_{CIR} in the target unit record UR_1 (step ST925).

In the case where the number of users N_{USER} exceeds the reference value V_{REF2} in step ST924, the processing unit 61 then uses a reference size V_{REF3} to compare with the data size I_{DS} of the content data CD that is retrieved from the content storage 64 (step ST926). The reference size V_{REF3} is a threshold for the

size of the content data CD to be transmitted under the conditions in the target unit record UR_1, and is set in advance with consideration of parameters that are typified by the respective transmission bandwidths of the first and second communications

5   circuits 4 and 5.

Here, the first communications circuit 4 has a wider bandwidth for data transmission than the transmission bandwidth of the second communications circuit 5. Accordingly, even when the number of users N_{USER} exceeds the reference value V_{REF2}, if the

10   processing unit 61 determines that the data size I_{DS} exceeds the reference size V_{REF3} in step ST926, step ST925 is carried out. Otherwise, the procedure goes to step ST923.

After either step ST923 or ST925 is completed, that is, after the communications circuit flag F_{CIR} is set, the processing

15   unit 61 determines if any unit record UR_1 is left yet unselected (step ST927). If any unit record UR_1 is determined to be unselected, the procedure repeats step ST921 and onward until no unit record UR_1 is left unselected. On the other hand, if no determined no, this is the end of the processing of FIG. 18.

20   With the processing of FIG. 18 being carried out, either the communications circuit 4 or 5 is applied to every unit record UR_1 in the first group. However, as already described, the second communications circuit 5 (satellite circuit) will soon be short of transmission bandwidth if the content data CD that is designated

25   by a number of unit records UR_1 is transmitted thereover. Therefore,

if the number of unit records UR_1 that are assigned 0 in the communications circuit flag F_{CIR} becomes large in step ST92, the server 6 is placed in a wait state for transmitting the content data CDs of some unit records UR_1, thereby possibly causing those

5   not to be ready in the DCE 3 by their own time limits LT. In order to avoid this, after step ST92 is completed, the processing unit 61 determines, for every content data CD that is designated by each of the unit records UR_1 in the first group, whether the transmission of each designated content data CD can be completed

10   by their own time limits LT (step ST93). In detail, the determination is made, for the unit record UR_1 that is assigned 1 in the communications circuit flag F_{CIR}, by comparing its time limit LT with a transmission completion time. Here, the transmission completion time from the current time is approximately

15   calculated from the transmission bandwidth of the first communications circuit 4 and the size I_{DS} of the content data CD. For the unit record UR_1 that is assigned 0 in the communications circuit flag F_{CIR}, the same manner as described above is applicable, but the transmission bandwidth that is used for calculation of

20   the transmission completion time is of the second communications circuit 5. With such processing being executed, if the processing unit 61 determines that every content data CD in the first group is transmittable by each of their time limits LT, the processing of FIG. 17 is ended.

25   On the other hand, if the processing unit 61 determines

that the content data CD that is designated by at least one unit

record UR_1 as being nontransmittable by each respective time limit

LT, a communications validity V_{CR} is calculated for every unit

record UR_1 (step ST94). Hereinafter, any unit record UR_1 whose

5   content data CD is determined as being nontransmittable by the

time limit LT in step ST93 is referred to as a nontransmittable

unit record UR_1. The communications validity V_{CR} is an indicator

that is used to verify the reliability of the communications circuit

that is selected in step ST92. Here, as the communication

10   validities V_{CR} are calculated differently for the first and second

communications circuit 4 and 5, the communications validity V_{CR}

for the first communications circuit 4 is referred to as a

communications validity V_{CR1}, while the communications validity

V_{CR} for the second communications circuit 5 is referred to as a

15   communications validity V_{CR2}. For the unit record UR_1 that is

assigned 1 in the communications circuit flag F_{CIR}, the

communications validity V_{CR1} becomes higher as the number of users

N_{USER} in the identifier ID_{USER} becomes fewer, the size I_{DS} of the

content data CD becomes larger, and the time margin TM becomes

20   longer. Conversely, for the unit record UR_1 that is assigned 0

in the communications circuit flag F_{CIR}, the communications validity

V_{CR2} becomes higher as the number of users N_{USER} in the identifier

ID_{USER} increases, the size I_{DS} of the content data CD becomes smaller,

and the time margin TM becomes shorter.

25   After step ST94 is completed, the processing unit 61

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searches the nontransmittable unit record(s) UR_1 so as to find a reference unit record UR_1 showing the closest time limit TM to the current time (step ST95). Then, the processing unit 61 selects a potential unit record UR_1 from among those unit records UR_1 in

5   the first group except for the nontransmittable unit record(s) UR_1. Here, the potential unit record UR_1 is the one satisfying a second condition of having the closer time margin TM to the current time and the communications validity V_{CR} which is lower than the reference unit record UR_1, and being assigned the same

10 communications circuit flag F_{CIR} as the reference unit record UR_1 (step ST96).

The processing unit 61 then transmits the content data CD that is specified by the potential unit record UR_1 over the communications circuit that is different from the communications

15 circuit currently assigned thereto, and determines if the content data CD that is specified by the reference unit record UR_1 is transmittable by the time limit LT (step ST97). Here, the processing of step ST97 is described in detail. As for the content data CD that is specified by the potential unit record UR_1, a

20 transmission time from the server 6 to the DCE 3 can be calculated from its data size I_{DS} and the transmission bandwidth of the communications circuit depending on which of the communication circuits has been applied thereto. In the same manner as described above in step ST93, a transmission completion time ET of the

25 reference unit record UR_1, which shows the time in which the

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specified content data CD reaches the DCE 3, can be calculated

based on the current time. If the transmission time that is

calculated for the potential unit record UR_1 is deducted from the

calculated transmission completion time ET of the reference unit

5   record UR_1, a new transmission completion time ET is approximated

for the case where the content data CD that is specified by the

potential unit record UR_1 is transmitted over the communications

circuit that is different from the communications circuit currently

applied thereto. If the approximated new transmission completion

10 time ET comes earlier than the time limit LT of the reference unit

record UR_1, the processing unit 61 determines the time limit LT

of the reference unit record UR_1 as assurable, and thus changes,

in value, the communications circuit flag F_{CIR} of the potential

unit record UR_1 (step ST98). Conversely, if the new transmission

15 completion time is not earlier than the time limit LT of the reference

unit record UR_1, the processing unit 61 changes, in value, the

communications circuit flag F_{CIR} of the reference unit record UR_1

(step ST99). After step ST98 or ST99 is completed, the procedure

returns to step ST93 and repeats the above-described processing.

20   Described next, schematically, is the processing of

steps ST94 to ST99 with reference to FIGS. 20a and 20b. In this

example, it is assumed that determination made in step ST93 is

NO, and five unit records UR_{1i}, UR_{1j}, UR_{1k}, UR_{1l}, and UR_{1m} have the

same communications circuit flag F_{CIR} but vary in time limit LT

25 from LT_i to LT_m as shown by the time axis t of FIG. 20a. On the

time axis t, content data CDs that are specified by the unit records UR_{1i} to UR_{1m}, respectively, are also indicated by the transmission completion times ET_i to ET_m. In this case, as is known from the transmission completion times ET_k and ET_l which are after the time limits LT_k and LT_l, the unit records UR_{1k} and UR_{1l} are selected as the nontransmittable unit record UR_1. In FIG. 20a, the unit records UR_{1i} to UR_{1m} are also indicated by the communications validity V_{CR1} to V_{CRm}, respectively.

In this example, the unit record UR_{1k} is selected as the reference unit record UR_1 in step ST95, and the unit record UR_{1j} is selected as the potential unit record UR_1 in step ST96. Then, in step ST97, the content data CD of the unit record UR_{1j} is transmitted over the communications circuit that is different from the communications circuit that is assigned thereto so as to determine whether the time limit LT_k of the reference unit record UR_{1k} is assurable. If the time limit LT_k of the reference unit record UR_{1k} is determined to be assurable in step ST98, as shown in FIG. 20b, the communications circuit flag F_{CIR} of the unit record UR_{1j} is changed in value so that the unit record UR_{1j} will be sent out onto the other communications circuit.

Refer to FIG. 10 again. The processing unit 61 carries out data send-out and charge processing so as to transmit the content data CD to the user and charge therefor (step ST10). Although the data send-out and charge processing is presumed here to be carried out after scheduling (step ST9), the first embodiment is

not restricted thereto, and step ST10 may be carried out also within a predetermined interval. Step ST10 corresponds to a data send out part herein, and FIG. 21 shows the detailed processing procedure thereof. In FIG. 21, the processing unit 61 first refers to the addressee list L_{DEST} so as to select any one unit record UR_1 to which the communications circuit flag F_{CIR} is set and its time limit LT is closest to the current time (hereinafter, referred to as transmission target unit record UR_1) (step ST101). Then, the processing unit 61 retrieves, from the content storage 64, any content data CD having the same identifier ID_{CD} as in the transmission target unit record UR_1 (step ST102). The processing unit 61 also extracts the identifier ID_{USER} from the transmission target unit record UR_1 (step ST103).

The processing unit 61 then generates transmission data TD such as the one shown in FIG. 13g (step ST104). In FIG. 13g, the transmission data TD includes an identifier ID_{TD}, an identifier ID_{CD}, an identifier ID_{USER}, an identifier ID_{SERVER}, and a content data CD. Here, the identifier ID_{TD} specifies the received signal as being the transmission data TD. The identifier ID_{CD} and the identifier ID_{USER} are the identifiers which are set in the transmission target unit record UR_1. The identifier ID_{SERVER} specifies from which server 6 the transmission data TD came. The content data CD is the one that is retrieved in step ST102.

After step ST104 is completed, the processing unit 61 checks the communications circuit flag F_{CIR} in the transmission

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target unit record UR_1 for its value (step ST105). If the communications circuit flag F_{CIR} shows 1, the processing unit 61 forwards the transmission data TD that is generated in step ST104 to the circuit interface 62 (see FIG. 3). In response, the circuit

5   interface 62 converts the received transmission data TD into a format which is suitable for the first communications circuit 4 before sending out the received transmission data TD onto the first communications circuit 4 as shown by sequence SQ7 of FIG. 11 (step ST106).

10   On the other hand, if the communications circuit flag F_{CIR} shows 0 in step ST105, the transmission data TD is forwarded to the transmission unit 63 of the server 6. In the transmission unit 63, the transmission data TD is then subjected to the conversion processing before being sent out onto the second communications

15   circuit 5 (step ST107). For the sake of convenience, such transmission data TD that is not sent out onto the second communications circuit 5 is not shown.

After step ST106 or ST107 is completed, the processing unit 61 carries out charge processing. In detail, the processing

20   unit 61 makes an access to the charge list storage 66 (see FIG. 6) so as to extract, from the charge list L_{PAY} therein, the charge information I_{PAY} each corresponding to the identifier ID_{USER} that is set in the transmission target unit record UR_1 (step ST108). Then, the processing unit 61 adds, to each of the retrieved charge

25   information I_{PAY}, the transmission expense TC that is found in the

transmission target unit record UR_1 (step ST109) so that the charge information I_{PAY} is updated. The processing unit 61 then makes another access to the charge list storage 66 so as to register the updated charge information I_{PAY} and the corresponding identifier ID_{USER} in the charge list L_{PAY} (step ST110). In this manner, the user is charged for the currently-received content data CD according to the amount that is written in the transmission expense TC.

After step ST1010 is completed, the processing unit 61 deletes the current transmission target unit record UR_1 from the addressee list L_{DEST} (step ST1011), and then determines if any unit record UR_1 is left unselected as the transmission target unit record UR_1 (step ST1012). If any unit record UR_1 is left unselected, the procedure returns to step ST101 so as to repeat the above-described processing. If no unit records UR_1 are left unselected, this is the end of this step ST10.

After sending out the transmission data TD onto the first communications circuit 4 in step ST106, the transmission data TD goes through several exchange systems 41 before being received by the circuit interface 33 of the DCE 3. The circuit interface 33 reconverts the transmission data TD before forwarding the transmission data TD to the processing unit 31. In response, the processing unit 31 carries out data storage processing (step ST11). FIG. 22 shows the detailed processing procedure thereof. In FIG. 22, the processing unit 31 stores at least the identifier ID_{CD}

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and the content data CD of the received transmission data TD into a predetermined recording area in the content storage 35 (step ST111). Here, the predetermined recording area is the recording area that is reserved in step ST5.

5   Next, the processing unit 31 generates a storage completion notice AS_{CD} (step ST112), which is data indicating that the content data CD that is requested by the content reservation request RS_{TR} has been stored. Typically, the storage completion notice AS_{CD} is data in the HTML (Hyper Text Markup Language) format

10 or an e-mail. Note that in order to generate data in the HTML format, the DCE 3 needs to function as a WWW server, and to generate an e-mail, the DCE 3 needs to function as a mail server. In the case where the DCE 3 functions both as the WWW server and the mail server, the DCE 3 needs to be set in advance, by the user's operation

15 or by default, in which format such a to-be-generated storage completion notice AS_{CD} is to be transmitted.

       After step ST112, the processing unit 31 checks whether the DTE 1 is ON (step ST113), and if the DTE 1 is ON, the processing unit 31 forwards the generated storage completion notice AS_{CD} to

20 the user interface 32. The user interface 32 then converts the storage completion notice AS_{CD} into a format which is suitable for the transmission path 2 before sending out the storage completion notice AS_{CD} onto the transmission path 2 (step ST114). The storage completion notice AS_{CD} is the received by the DTE 1

25 (sequence SQ8).

It should be noted that, if step ST107 is carried out, the transmission data TD is transmitted over the second communications circuit 5. In detail, the server 6 notifies a predetermined multicast address to the DCE 3 which is to receive the current transmission data TD. Then, the server 6 generates the transmission data TD having the multicast address set as the identifier ID_{USER} therein (see FIG. 13g). Such transmission data TD goes through, from the transmission unit 63 of the server 6, the transmission antenna 51, the artificial satellite 52, and the reception antenna 53, and is then received by the reception unit 34 of the DCE 3, which has been notified of the multicast address in advance. If this is the case, the reception unit 34 is the one which subjects the transmission data TD to the reconversion processing before forwarding the transmission data TD to the processing unit 31. Then, responding to the transmission data TD, the processing unit 31 carries out the data storage processing in the same manner as described above but only if the transmission data TD carries the notified multicast address. If the transmission data TD carries some other identifier ID_{USER}, the processing unit 31 needs to discard the transmission data TD. This is because the transmission data TD reaches every DCE 3 in the data transmission system once the transmission data TD is sent out onto the second communications circuit 5.

Upon reception of the storage completion notice AS_{CD}, the DTE 1 shows the user a message indicating that the content

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data CD at his/her request has been stored (step ST12). The user

thus knows that the requested content data CD has reached the DCE

3. The user operates the DTE 1, whenever convenient, so as to

designate the content data CD that is stored in the DCE 3. In

5   response, the DTE 1 generates a read request RS_{RO} (step ST13),

which is a signal that requests the DCE 3 to read the user designated

content data CD from the content storage 35.

The read request RS_{RO} is converted by the DTE 1 into

a format which is suitable for the transmission path 2, sent out

10   onto the transmission path 2, received by the user interface 32

of the DCE 3 (see FIG. 2), reconverted in the user interface 32,

and is then forwarded to the processing unit 31 (sequence SQ9).

Upon reception of the read request RD_{RO}, the processing unit 31

reads the currently designated content data CD from the content

15   storage 35 and forwards the currently designated content data CD

to the user interface 32. The content data CD is converted in

the user interface 32 and is sent out onto the transmission path

2, and thus is received by the DTE 1 (step ST14) (sequence SQ10).

The DTE 1 reconverts the content data CD, and then carries out

20   the output processing thereon so as to present the user with what

the content data CD carries (step ST15).

Here, in step ST113 of FIG. 22, if the processing unit

31 determines that the DTE 1 is OFF, the storage completion notice

AS_{CD} is retained in the processing unit 31 until the DTE 1 is turned

25   ON (step ST115). Once the DTE 1 is detected to be turned ON,

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the processing unit 31 forwards the retained storage completion notice AS_{CD} to the user interface 32 and then to the DTE 1 via the transmission path 2. Thereafter, the processing of steps ST12 to ST15 is carried out between the DTE 1 and the DCE 3.

5   As described in the foregoing, in the data transmission system of the first embodiment, the server 6 can selectively send out transmission data TD onto the communications circuits 4 and 5 in consideration of their respective suitability for multicasting. Accordingly, when many users are requesting that the same content data CD be transmitted, the server 6 basically selects the second communications circuit 5, which is suited for multicasting. Thus, the data transmission can be done with a cheaper transmission expense, which is good for users. Therefore, according to the first embodiment, the present data transmission system is more advantageous in view of cost performance to the conventional data transmission system.   By the way, Japanese Patent Laid-Open Publication NO. 10-41976 (98-41976) discloses a method for selecting one communications circuit from among those communication circuits connecting several terminals depending on the size of transmitting data. Here, if this method is combined with the data transmission system of Japanese Patent Laid-Open Publication No. 8-140081 (96-140081) referred to in the description of the Prior Art above (hereinafter, referred to as a conventional data transmission system), a dispute may arise about the difference from the data transmission system of the first embodiment. With

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such a combination, however, an efficient use of the communications circuits cannot be achieved unlike the data transmission system of the first embodiment. This is because, with the combination, a time when to transmit the data is first determined, and then

5   which communications circuit is to be used therefore is determined. Under such control of this combination, however, no consideration is given to suitability of the communications circuits. Thus, it may happen that first data which is not so popular among users is transmitted over a communications circuit which is suitable

10   for multicasting, and in the meantime, even if second data which is quite popular needs to be transmitted, the communications circuit is not available for the transmission of the second data. As a result, the second data has to be transmitted over another communications circuit which is not suitable for multicasting.

15   On the other hand, in order to determine a time when to transmit transmission data TD and which communications circuit to use for the transmission of the transmission data TD, the data transmission system of the first embodiment carries out scheduling (step ST9; specifically, steps ST921 to ST926) while referring

20   to a time limit LT and communications information (e.g., the state of the communications circuits 4 and 5, the number of users N_{USER}, and the data size I_{DS}) of every unit record UR_1 satisfying the first condition. Further, to avoid such a problem as in the above-described combination, the data transmission system of the

25   first embodiment uses a communications validity V_{CR} to verify the

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reliability of the selected communications circuit (see steps ST94 to ST99). In this manner, the data transmission system of the first embodiment achieves an efficient use of the communications circuits 4 and 5; that is, the data transmission system of the first embodiment controls communications traffic, while ensuring the user designated time limit LT.

Further, according to the first embodiment, the server 6 uses content reservation status data D_{RS} to show the user what are the conditions for downloading his/her requested content data CD and how many other users are so far requesting the same content data CD. The content reservation status data D_{RS} is also utilized for inducing other users by showing what content data CD is available under what conditions. Once the user finds any condition matching his/her needs, the DTE 1 generates and transmits a content reservation request RS_{TR} including a DL condition number N_{DL} corresponding to the conditions. Upon reception of the transmitted content reservation request RS_{TR}, the server 6 updates the corresponding unit record UR_1 so that the transmission expense TC of the content data CD is accordingly reduced. Therefore, the user can acquire the content data CD with less expense if her/his request is transmitted together with some other users' resquests.

Even if the user does not find conditions matching his/her needs, the user can designate his/her own conditions. In this case, the later his/her designated time limit LT shows, the cheaper his/her expense for the content data CD becomes.

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Note that, in the first embodiment, the conditions for downloading the content data CD is exemplified by the time limit LT. The first embodiment, however, is not restricted thereto, and the transmission expense TC and the number of users N_{USER} may

5   be also included. With the transmission expense TC, the procedure goes to step ST92 when the transmission expense TC in every unit record UR_1 satisfying the first condition becomes a predetermined value or lower in step ST91 in the scheduling processing of FIG. 17. On the other hand, with the number of users N_{USER}, the procedure

10   goes to step ST92 when the number of users N_{USER} in every unit record UR_1 satisfying the first condition becomes a predetermined value or more in step ST91.

Further, in the first embodiment, when the incoming content reservation request RS_{TR} is in such form as the one

15   illustrated in FIG. 13b, the procedure goes through steps ST88 to ST811 of FIG. 15, and the processing unit 61 thus generates a new unit record UR_1 to be added to the addressee list L_{DEST}. However, if the addressee list L_{DEST} already carries any unit record UR_1 which satisfies a third condition, this is not restrictive. Here,

20   the unit record UR_1 satisfying the third condition is the unit record UR_1 having the earlier time limit LT and the cheaper transmission expense TC than the new unit record UR_1, and showing the same content data CD as the new unit record UR_1. If such a unit record UR_1 is found in the addressee list L_{DEST}, the identifier

25   ID_{USER} of the new unit record UR_1 is written thereinto, and the

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transmission expense TC in the list is accordingly updated. In

this manner, as far as the content data CD becomes ready in the

DCE 3 sooner than the user designated time limit LT, the user settles

for nothing, and if anything, has the merits of a cheaper expense.

5   Here, the processing unit 61 may carry out the same

processing as described above when, in the addressee list L_{DEST},

one unit record UR_1 shows the cheapest transmission expense TC

and the earliest time limit LT among all of the unit records UR_1

corresponding to the same content data CD.

10   Further, in the first embodiment, the DCE 3 is

exemplified as simply transmitting the content data CD to the DTE

1 in response to a read request RS_{RO} from the DTE 1. This is not

restrictive, and the processing unit 31 of the DCE 3 may delete

the received content data CD from the content storage 35 immediately

15   after the transmission of the content data CD or after a

predetermined time interval. Alternatively, even if no read

request RS_{RO} comes from the DTE 1, the processing unit 31 may store

the received content data CD in the content storage 35, and then

delete the content data CD after a predetermined time interval.

20   If those are the cases, the timing of deletion is added to the

transmission data TD before being transmitted to the DCE 3 or is

previously registered in the DCE 3.

In the first embodiment, as shown by the sequence SQ8

of FIG. 10, a storage completion notice AS_{CD} is exemplified as

25   being transmitted to the DTE 1 from the DCE 3. This is not

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restrictive, and the server 6 may perform the transmission after
receiving the transmission data TD.

Also in the first embodiment, as shown by the sequence
SQ1 of FIG. 9, the content reservation status data D_{RS} is exemplified
as being transmitted to the DTE 1 via the DCE 3. This is not
restrictive, and the DTE 1 may directly transmit the content
reservation status data D_{RS} in response to the user's operation.
In this case, the user refers to the content reservation status
data D_{RS} on the DTE 1 which is not connected to the DCE 3. Note
that the content reservation request RS_{TR} still needs to carry
the identifier ID_{USER} of the DCE 3 as the content data CD is stored
in the DCE 3.

Also in the first embodiment, the server 6 is exemplified
as including the addressee list storage 65, the charge list storage
66, the transmission expense list storage 67, and the transmission
initial expense list storage 68. This is not restrictive, and
the server 6 may be simply in charge of generating and transmitting
the content reservation status data D_{RS} and transmitting the content
data CD, and leave other processing to other equipment in the data
network 7 or to some other server connected thereto.

Also, the DCE 3 may be configured so as to also be
connectable to a telephone and/or facsimile. If connected in such
a manner, information such as service class comes over the first
communication circuit 4, for example, together with audio data
for telephone and/or character data for facsimile. Thus, the DCE

50

3 refers to such information and forwards the audio data and/or character data to the telephone and/or facsimile, respectively, prior to the transmission data TD and content reservation status data D_{RS}. This is because such data needs to be responded to in

5   real time.

Also in the first embodiment, the timing of transmission is exemplified as being determined for every unit record UR_1 in order of the increasing time limit LT. This is not restrictive, and the transmission time may be determined. In such case, the

10   transmission time also has to ensure the time limit LT.

Further, in the first embodiment, the content data CD is exemplified as being stored in the content storage 64 together with the identifier ID_{CD} and the data size I_{DS} added thereto for clarity. This is not restrictive, and the content storage 64 stores

15   only the content data CD, and assigns the identifier ID_{CD} that is unique thereto when the processing unit 61 generates the transmission data TD.

Also in the first embodiment, one content data CD is transmitted from the DCE 3 to the DTE 1. The number of content

20   data CD is not restrictive, and the content data CD that are designated by read request RS_{RO} may be transmitted together with any other which is not designated thereby. If this is the case, the applicability is accordingly widened. For example, assume that a read request RD_{RO} is issued for content data CD which is

25   a movie. In response thereto, the DCE 3 may transmit, to the DTE

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1, the requested content data CD together with other content data CD which is an advertisement. Accordingly, the DTE 1 can display both the movie and the advertisement on its screen.

Also in the first embodiment, the content data CD is exemplified as carrying moving picture data, static picture data, audio data, object data, character data, or a combination of two or more of such data. This is not restrictive, and the content data CD may also carry a program which changes the contents thereof (e.g., characters) for display. For example, when a program instructs the DTE 1 to display a letter of "A" in a first period but a letter of "B" in a second, the DTE 1 follows such an instruction.

As another example, assume that a read request RD_{RO} is issued for the content data CD which is a WEB page. In response thereto, the DCE 3 may transmit, to the DTE 1, the requested content data CD together with other content data CD which is a banner advertisement (or an information link to advertisement), which is not requested by the user. Accordingly, the DTE 1 can display both the WEB page and the banner advertisement on its screen, thereby leading to advertisement revenue for information providers.

Also in the first embodiment, the content data CD is exemplified as being chargeable. However, there may also be free content data. For any server containing only such free content data in the data transmission system, only free content data needs to be transmitted to the DTE 1 via the DCE 3, if requested, without going through such processing as scheduling and charging in the

first embodiment. In such a case, the DCE 3 counts how often the DTE 1 has so far requested the same free content data. As for any free content data which is popular among users, the DCE 3 inquires, during when communications traffic of the first communications

5   circuit 4 is low, the server if the content data has been updated. If the content data has been updated, the server responsively transmits the latest version of the content data CD to the DCE 3. The DCE 3 then stores the received content data CD in the content storage 35. As such, the DCE 3 may carry out cache processing

10   so as to acquire any new free content data, autonomously, irrespective of whether a transmission request comes from the DTE 1. Unlike the DTE 1 which is basically turned ON and OFF by the user, the DCE 3 is always ON. This is the reason why the DCE 3 can carry out such a cache processing spontaneously.

15   In the above-described cache processing, the DCE 3 can know the level of the communications traffic with the following three techniques. First, the DCE 3 inquires any one of the exchange systems 41 in the first communications circuit 4 about the current traffic level, and then uses a predetermined reference value for

20   comparison therewith. Second, any one the exchange systems 41 notifies the DCE 3 about the current traffic level, and the DCE 3 then uses the reference value for comparison. Lastly, the DCE 3 is provided with a timer, and carries out the cache processing when the timer indicates a predetermined time. The time may be

25   during a period from late-night to early-morning when the

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communications traffic is lowered on the first communications circuit 4.

For the cache processing, the recording area in the content storage 35 is preferably divided into smaller areas. Some smaller areas of the content storage 35 are allocated for storing chargeable content data CDs, and some smaller areas are allocated for free content data that are acquired by the DCE3 through the cache processing. This prevents the recording area from being wholly occupied by the free content data after the cache processing.

If the transmission request is received from the DTE 1, the DCE 3 checks to see whether the content data CD that is designated thereby is stored in any of those smaller areas of the content storage 35. If the content data CD is stored in one of the smaller areas, the DCE 3 reads the content data therefrom without accessing the server, and transmits the read content data to the DTE 1. Such cache processing allows the DTE 1 to quickly acquire the content data at the user's request. Also, since the cache processing is carried out when the communication traffic level is low, the communications traffic can be controlled on the basis of time, thereby improving the first communications circuit 4 in transmission efficiency.

In the first embodiment, the DCE 3 is exemplified as acquiring the chargeable content data CD from the server 6. This is not restrictive, and the DCE 3 may carry out processing so as share the free content data with other DCEs 3. In the process,

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the DCE 3 (the one which receives data) inquires other DCEs about the content data (especially the popular content data). The inquired DCEs 3 responsively check themselves to determine if they are carrying the content data, and if any of the inquired DCEs

5 carries the content data, the content data is transmitted therefrom to the inquiring DCE 3.

Alternatively, the server 6 manages information, in the form of a list, indicating which DCE 3 in the data transmission system carries what content data, and the server 6 transmits the

10 list to the DCE 3 which is looking for any specific content data. With the help of this list, the content data can be quickly located and acquired by data communications only between two DCEs 3.

Accordinly, by sharing the content data among many DCEs, server access is reduced, and further, the content data becomes

15 quickly available if the content data is located in the closer DCE 3.

In the case where the DCE 3 wants to acquire a content data CD but the recording area in the content storage of the DCE 3 has an insufficient capacity to store the desired content data

20 CD, the DCE 3 requests any of the other DCEs 3 to store the content data CD therein. If the request is accepted, the content data CD is stored in the other DCE 3 until the DCE 3 finds sufficient room in its recording area to store the desired content data CD. Then, the DCE 3 communicates with the other DCE 3 to acquire the

25 content data CD therefrom.

Here, the DCE 3 may be implemented with SMTP (Simple Mail Transfer Protocol) and POP (Post Office Protocol) to function as a mail server. If this is the case, as in the above, e-mails are preferably distributed when the communications traffic on the

5   first communications circuit 4 is low. As to a high priority e-mail, however, the DCE 3 preferably distributes the high priority e-mail regardless of the communications traffic on the first communications circuit 4. Here, since the DCE 3 is powered ON all of the time, the DCE 3 always receive e-mails. The DTE 1 thus

10 carries out an e-mail program, and accesses the DCE 3 responding to the user's operation to receive e-mails. In particular, the DTE 1 receives e-mails from the DCE 3 in close proximity thereto without having to use the first communications circuit 4, and thus, those e-mails become available to the user sooner.

15 The DCE 3 may also be implemented with a program to realize a fire wall, which prevents malicious hackers from breaking into the DCE 3 and the DTE 1. More specifically, the DCE 3 carries a list indicating a qualified data addresser and addressee, and if any data comes from those that are not listed, the DCE 3 discards

20 the data. The DCE 3 also discards data that is addressed to an addressee which is not found in the list. Accordingly, the DTE 1 can be protected from so-called spam. For a case where a child operates the DTE 1, the list may be password protected so as to prevent the DTE 1 from receiving content data including sexual

25 and violent descriptions or content. Further, the DCE 3 detects

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unauthorized data that are typified by a virus in data that is transmitted from/received by the circuit interface 33. Such detected unauthorized data are discarded with no exception, whereby the DTE 1 can be protected from virus infection.

5　　　　　Also in the first embodiment, the DCE 3 responds to a read request RS_{RO} from the DTE 1, and transmits a content data CD itself to the DTE 1. Here, if the DCE 3 functions as a WWW server, the DCE 3 assigns the content data CD a URL (Uniform Resource Locator), and stores the URL in the content storage 35. Also,

10　the DCE 3 generates in advance an HTML file including a simple description of the assigned URL and the content data CD. Accordingly, the user can refer to any content data CD not only via the DTE 1 that is connected to the DCE 3 through the transmission path 2 but also via other equipment (e.g., a personal computer,

15　a cellular phone, and an information mobile terminal) having a WWW browser that is implemented therein. The same is applicable if the DCE 3 generates an e-mail including a simple description of the assigned URL and the content data CD, and the DCE 3 accordingly transmits the e-mail with a preassigned e-mail address. Here,

20　whether the DCE generates the HTML file or e-mail may be up to the user based on the content data CD.

Second Embodiment

　　　　　Described next is a data transmission system according to a second embodiment of the present invention. Basically, the

25　data transmission systems of the first and second embodiments are

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structurally the same as shown in FIG. 1, and herein, any component

which is new in the second embodiment is described in detail, but

the constituent elements of the data transmission system of the

second embodiment which are the same as those of the first embodiment

5   are otherwise provided with the same reference numeral as in the

first embodiment and are not described again.

Described first is the server 6, whose structure is shown

in FIG. 3. However, in the second embodiment as shown in FIG.

23a, several content data CD sets CDS are stored in the content

10   data storage 64, not the content data CD as in the first embodiment.

In FIG. 23a, each content data set CDS includes an identifier ID_{CDS},

a data size I_{DSS}, and several combinations of attribute information

I_{AT} and corresponding content data CD. The identifier ID_{CDS} uniquely

specifies the location where the content data set CDS is stored

15   (i.e., the recording area in the content storage 64 of the server

6) in the data transmission system. The data size I_{DSS} indicates

the content data set CDS by size, and the attribute information

I_{AT} indicates the corresponding content data CD by attribute. With

regard to the content data CD, no mention is given here as the

20   content data CD is the same as in the first embodiment. Here,

the content data set CDS may include the identifier ID_{CD} and the

data size I_{DS} for the corresponding content data CD as in the first

embodiment, but this is not essential here and is neither described

nor shown.

25   The content data set CDS is specifically described next.

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In the second embodiment, the content storage 64 stores content data sets CDS_1 and CDS_2. The content data CDS_1 is presumably an advertisement this is made by a shop or a company, and carries p (a natural number equal to or larger than 1) content data CD_{11}

5   to CD_{1p} each varying in content. The content data CD_{11} is provided with attribute information I_{AT11} corresponding thereto. Similar to other content data CD_{12} to CD_{1p}, attribute information I_{AT12} to I_{AT1p} is respectively provided.

The attribute information I_{AT11} indicates the content

10 data CD_{11} by attribute. Specifically, as shown by FIG. 23b, the attribute information I_{AT11} is composed of category information I_{CA11}, name information I_{SP11}, product information I_{GD11}, and price information I_{PR11}. The category information I_{CA11} indicates the advertisement that is specified by the corresponding content data

15 CD_{11} by category, i.e., the advertiser's business. The name information I_{SP11} indicates the advertiser by shop or company name, the product information I_{GD11} indicates the product or service in the advertisement, and the price information indicates the price of the product or service. Note that the attribute information

20 I_{AT11} is not limited only to such a category, name, product, and price, and may, for example, also include information indicating the number of stocks of the product. Similar to the attribute information I_{AT11}, other attribute information I_{AT12} to I_{AT1p} is composed of, respectively, the category information I_{CA11} to I_{CA1p},

25 the name information I_{SP11} to I_{SP1p}, the product information I_{GD11}

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to I_{GD1p}, and the price information I_{PR11} to I_{PR1p}.

Next, the content data set CDS_2 is herein presumably news, and carries q (a natural number equal to or larger than 1) content data CD_{21} to CD_{2q} each varying in content. The content

5 data CD_{21} is provided with attribute information I_{AT21} corresponding thereto. Similar to other content data CD_{22} to CD_{2q}, attribute information I_{AT22} to I_{AT2q} is respectively provided. The attribute information I_{AT21} to I_{AT2q} indicates the corresponding content data CD_{21} to CD_{2q} by attribute, and, as shown in FIG. 23c, is specifically

10 composed of the category information I_{CA21} to I_{CA2q} each varying in content depending on the corresponding content data CD_{21} to CD_{2q}. For example, the category information I_{CA21} to I_{CA2q} for the content data CDS_2 may be entertainment, finance, sports, and the like.

15 Described next is the DCE 3. As shown in FIG. 24, the differences between the DCE 3 of the second embodiment and the DCE 3 (see FIG. 2) in the first embodiment are a selection condition list storage 36 and an allocation list storage 37. The selection condition list storage 36 and the allocation list storage 37 store,

20 respectively, a selection condition list L_{SC} and an allocation list L_{ST} (both will be described later).

Described next with reference to the sequence charts of FIGS. 25 and 26 is the communications procedure for the DTE 1 to acquire a content data CD in the above structured data

25 transmission system. The sequence chart of FIG. 25, as compared

with the sequence chart of FIG. 9, additionally includes steps ST21 and ST22, and sequence SQ21. The rest of FIG. 25 is basically the same as FIG. 9, and thus the steps and sequences which are the same as those in FIG. 9 are denoted by the same step and sequence numbers, and only a difference, if any between the respective steps and sequence numbers are described herein. As for the sequence chart of FIG. 26, as compared with the sequence chart of FIG. 10, steps ST11 and ST14 are replaced by steps ST11' and ST14', and additionally includes ST23. The rest is basically the same as FIG. 10, and thus the steps and sequences which are the same as those in FIG. 10 are denoted by the same step and reference numbers, and only a difference, if any, between the respective steps and sequence numbers are described herein.

First, in FIG. 25, the DTE 1 carries out selection condition setting request processing according to the user's operation (step ST21). More specifically, as shown in FIG. 27a, the DTE 1 displays a selection condition input form IF_{SC}. The user operates the DTE 1 so as to input several keywords W_{KEY} into the selection condition input form IF_{SC}. Here, the keywords W_{KEY} are the ones which are used to define the content data CD by attribute. For example, if the user wants to see food advertisements carrying the lowest price, the user inputs the corresponding keywords W_{KEY} into the selection condition input form IF_{FS} to define what he/she wants. In response, the DTE 1 generates a selection condition setting request RS_{SCS}, which is a signal requesting the DCE3 to

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set a selection condition(s) SC therein to forward only content data CDs matching the user's preferences. The signal includes at least the identifier ID_{scs} and the inputted keywords W_{KEY}, and the identifier ID_{scs} therein specifies the signal as being a

5 selection condition setting request RD_{scs}. With the signal, the DCE 3 can grasp the user's preferences for the content data CDs.

Such a selection condition setting request RS_{scs} is converted into a format which is suitable for the transmission path 2 by the DTE 1, sent out onto the transmission path 2, and

10 received by the user interface 32 of the DCE 3 (see FIG. 2) (sequence SQ21). Then, in the user interface 32, the selection condition setting request RS_{scs} is reconverted before being received by the processing unit 31. The processing unit 31 then checks the identifier ID_{scs} in the received signal to determine if the signal

15 is a selection condition setting request RS_{scs}. If the signal is a selection condition setting request RS_{scs}, the processing unit 31 carries out the selection condition setting request processing (step ST22). FIG. 28 shows the detailed processing procedure of step ST22. In FIG. 28, the processing unit 31 extracts the keywords

20 W_{KEY} from the received selection condition setting request RS_{scs} (step ST221). Then, the processing unit 31 assigns a unique selection condition number N_{sc} to a selection condition SC which is structured by the retrieved keywords W_{KEY} (step ST222). The processing unit 31 then accesses the selection condition list

25 storage 36, and adds the current set of the selection condition

number N_{SC} and the selection condition SC in a selection condition list L_{SC} such as the one shown in FIG. 27b (step ST223). In such a form of the selection condition list L_{SC}, the user designated selection condition(s) SC are set to the DCE 3.

5   After the selection condition setting is completed, the same communications and processing are carried out in the data transmission system as in the first embodiment; that is, steps ST1 to ST10, and sequences SQ1 to SQ7 (see FIGS. 9 and 10). Note that although the processing was performed on the content data

10   CD basis in steps ST1 to ST10 in the first embodiment, the processing in the second embodiment is on the content data set CDS basis. In brief, the DTE 1 transmits a content reservation request RS_{TR} to the server 6 to request for the transmission of a content data set CDS. In response, with respect to the requested content data

15   set CDS, the server 6 carries out processing including scheduling, data transmission, charging, and the like. As a result, as compared with the transmission data TD of FIG. 13g, the transmission data TD that is transmitted in sequence SQ7 herein includes the identifier ID_{CDS} and the content data set CDS instead of the

20   identifier ID_{CD} and the content data CD.

As in the first embodiment, the transmission data TD is sent out onto an optimal communications circuit (the first or the second communications circuit 4 or 5). Herein, the optimal communications circuit is presumed to be the first communications

25   circuit 4. The transmission data TD on the first communications

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circuit 4 is received by the circuit interface 33 of the DCE 3

via several exchange systems 41, and is then forwarded to the

processing unit 31. Upon reception of the transmission data TD,

the processing unit 31 carries out data storage processing (step

5   ST11'). FIG. 29 shows the detailed processing procedure of step

ST11'. As compared with FIG. 22, step ST111 is replaced by steps

ST111' and ST112' in FIG. 29. Other steps which are identical

to those that are illustrated in FIG. 22 are denoted by the same

step numbers, and are not described again. In FIG. 29, out of

10   the received transmission data TD, the processing unit 31 stores

at least the content data set CDS into a predetermined recording

area of the content storage 35 (step ST111'). Here, the

predetermined recording area is the one which is reserved in step

ST5.

15   Next, the processing unit 31 carries out update

processing on the allocation list L_{ST} (step ST112'). More

specifically, as for every content data CD that is currently stored

in the content storage 35, the processing unit 31 adds, to an

allocation list L_{ST} such as the one shown in FIG. 30, an identifier

20   ID_{CDS} of the content data set CDS, address information I_{ADD} specifying

the location of the content data CD in the recording area, and

date and time information I_{DT} indicating when the content data

CD was stored (i.e., the current date and time). The allocation

list LST also has a section for a recording capacity C_{REC}, which

25   indicates a current available capacity of the recording area of

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the content storage 35. Thus, with the content data set CDS stored
in the content data storage 35 in step ST111', the processing unit
31 writes the resultant value into the recording capacity C_{REC}.
After step ST112' is completed, the procedure goes to steps ST112
and onwards, and the processing unit 31 transmits a storage
completion notice AS_{CD} to the DTE 1 (sequence SQ8).

After step ST12 is completed, the storage capacity C_{REC}
of the content storage 35 is decreased in value. Thus, the
processing unit 31 carries out data deletion processing (step ST23).
Step ST23 corresponds to a data deletion part herein, and FIG.
31 shows the detailed processing procedure thereof. In FIG. 31,
the processing unit 31 extracts the current recording capacity
C_{REC} from the allocation list L_{ST} (step ST231), and then measures
its level by comparing the current recording capacity C_{REC} with
a reference recording capacity C_{REF} (step ST232).

If the reference recording capacity C_{REF} is not less than
the current recording capacity C_{REC}, the processing unit 31
determines that the recording area of the content storage 35 is
still sufficiently available for recording a new content data CD,
and step ST23 is now completed. On the other hand, if the current
recording capacity C_{REC} is not more than the reference recording
capacity C_{REF}, the processing unit 31 determines that the recording
area of the content storage 35 is running out, and thus the procedure
goes to step ST233. Then, the processing unit 31 searches the
allocation list L_{ST} for the oldest date and time information L_{DT},

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and extracts the address information I_{ADD} corresponding thereto (step ST233).

The processing unit 31 then deletes (erases), from the recording area that is specified by the retrieved address information I_{ADD}, the content data set CDS (step ST234). The processing unit 31 also updates the allocation list L_{ST} (step ST235). In more detail, the processing unit 31 deletes, from the allocation list L_{ST}, the date and time information I_{DT} and the address information I_{ADD} that are acquired in step ST233, and the identifier ID_{CDS} corresponding thereto. Then, the processing unit 31 updates the recording capacity C_{REC} in the allocation list L_{ST} to a value reflecting the deletion of the content data set CDS. After step ST235 is completed, the procedure returns to step ST231 and repeats steps ST231 to ST235 until the recording capacity C_{REC} exceeds the reference recording capacity C_{REF}. In this manner, the recording area of the content storage 35 can be always available for data which is at least in size represented by the reference recording capacity C_{REF}.

With the storage completion notice AS_{CD} that is received by the DTE 1, the procedure goes to step ST12. From now on, it is up to the user to decide when to operate the DTE 1 so as to read the content data CDS from the DCE 3. When the DTE 1 is operated, the DTE 1 generates a read request RS_{RO} (step ST13). In the second embodiment, the read request RS_{RO} is a signal for requesting the DCE 3 to read the content data CDS at the user's request from the

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content storage 35.

The read request RS_{RO} is transmitted from the DTE 1 to the DCE 3 (sequence SQ9). In response to the read request RS_{RO} the processing unit 31 of the DCE 3 carries out the data transmission

5   processing of step ST14'. Step ST14' corresponds to a data transmission part herein, and FIG. 32 shows the detailed processing thereof. First, the processing unit 31 extracts every selection condition SC that is found in the selection condition list L_{SC} (see FIG. 27b) (step ST141'). Then, the processing unit 31 accesses

10   the content storage 35 so as to selectively read any content data CD satisfying the retrieved selection conditions SC from the user designated content data set CDS (step ST142'). The processing unit 31 then transmits the read content data CD(s) to the DTE 1 via the user interface 32 and the transmission path 2 (step ST143').

15   The DTE 1 then carries out output processing on the received content data CD(s) (step ST15), and the user can accordingly see what the content data CD(s) carry.

Therefore, in the second embodiment, the user sets, to the DCE 3, a selection condition SC such as the one shown in FIG.

20   27a to define what content data CD he/she wants. Assume here that five selection conditions SC as shown in FIG. 27b are set to the DCE 3. In response to the content reservation request RS_{TR}, the server 6 transmits a content data set CDS at the user's request to the DCE 3 with a timing that is determined through scheduling,

25   and the DCE 3 stores the received content data that is set in the

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content storage 35. Here, transmitted from the server 6 are presumably the content data sets CDS_1 and DCS_2 of FIG. 33, each of which carries a plurality of content data CDs. Specifically, as shown in FIG. 33, the content data set CDS_1 includes an identifier

5   ID_{CDS1}, a data size I_{DSS1}, and four content data CDs CD_{11} to CD_{14}. The content data CD_{11} carries category information I_{CA11} indicating as a food business, name information I_{SP11} as XX supermarket, product information I_{GD11} as a white radish, and price information I_{PR11} as ¥100. Similar to other content data CD_{12} to CD_{14}, attribute

10   information I_{AT12} to I_{AT14} (category information I_{CA12} to I_{CA14}, name information I_{SP12} to I_{SP14}, product information I_{GD12} to I_{GD14}, and price information I_{PR12} to I_{PR14}) are provided, respectively. The content data set CDS_2 includes an identifier ID_{CDS2}, a data size I_{DSS2}, and three content data CD_{21} to CD_{23}. Here, provided to the

15   content data CD_{21} is category information I_{CA21} as entertainment, while provided to the content data CD_{22} and CD_{23} are category information I_{CA22} and I_{CA23} as finance and sports, respectively.

In such a case, after the processing unit 31 carries out the data transmission processing (step ST14′) according to

20   the selection conditions SC (see FIG. 27b), the content data CD_{11}, CD_{22}, and CD_{23} are selected and transmitted to the DTE 1 via the user interface 32. In the example of FIG. 34, although every information accompanying the CD_{11}, CD_{22}, and CD_{23} is transmitted, essentially, only the CD_{11}, CD_{22}, and CD_{23} will do. In such a data

25   transmission system according to the second embodiment, since the

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user sets his/her selection conditions SC to the DCE 3, the user

can receive only content data CD of interest.

Here, in the second embodiment, the content data CD_{11}

to CD_{1p} are presumably all advertisements, and are accompanied

5   by attribute information I_{AT11} to I_{AT1p} corresponding thereto.

However, since the attribute (product price and the number of

stocks) and details of the advertisement are changeable, some

content data CD_1 and/or some attribute information I_{AT1} may be

already out of date at about the time when the content data set

10   CDS_1 reaches the DCE 3. To deal with this situation, the server

6 generates an information change request to be transmitted to

the DCE 3. Here, the information change request is a signal to

request the DCE 3 to update the content data CD_1 and/or the attribute

information to be the latest information, and the information

15   change request includes the identifier ID_{CD1}, the content data CD_1

in the latest version, and/or the attribute information I_{AT1}. In

response to such an information change request, the DCE 3 uses

the identifier ID_{CD1} therein to specify the recording area where

the content data CD_1 and/or the attribute information I_{AT1} is stored,

20   deletes the content data CD_1 and/or the attribute I_{AT1} from the

specified recording area, and then stores the content data CD_1

in the latest version and/or the attribute information I_{AT1} in the

content storage 35. With such processing, without transmitting

the content data set CDS_1 in its entirety, the content data CD_1

25   and/or attribute information I_{AT1} can be accordingly changed

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whenever a change is needed. In this sense, the transmission bandwidth of the first and second communications circuits 4 and 5 can be effectively utilized. Note that a transmission timing of such an information change request is preferably determined

5   in scheduling. It is preferable that the information change request reaches the DCE 3 sooner.

Also in the second embodiment, the DTE 1 first transmits a content reservation request RS_{TR} to the server 6 so as to acquire the content data set CDS_2 including various news. The content

10   data set CDS_2, however, may be transmitted to the DTE 1 due to push technology in some cases. To be more specific, the user of the DTE 1 sign-ups a distribution service of the content data set CDS_2 that is offered by the provider thereof (e.g., newspaper publishing company). In such a case, a server on the provider

15   side requests for the server 6 to transmit the content data set CDS_2 to the DCE 3 corresponding to the requesting user. At this time, the server on the provider side notifies the server 6 of the user's identifier ID_{USER}, the time limit LT, and the content data set CDS_2. In response to this notification, the server 6

20   generates transmission data TD by using the notified information.

Also in the second embodiment, the out-of-date content data set CDS is deleted when the recording capacity C_{REC} of the content storage 35 is running short (see step ST23). This is not restrictive, and the out-of-date content data set CDS may be deleted

25   when an expiration date previously provided thereto arrives.

Alternatively, the out-of-date content data set CDS may be deleted with a lapse of a predetermined time that is measured from the time that the content data set CDS was generated. Here, information indicating the date and time when the advertisement is made is

5 previously provided to the content data set CDS. Such information indicating the expiration date and the date and time corresponds to deletion timing information herein.

Also in the second embodiment, the DCE 3 is exemplified as reading any content data CD satisfying the selection conditions

10 SC from the content storage 35 before transmitting the read content data CD to the DTE 1. This is not restrictive, and the processing unit 31 may select any content data CD satisfying the selection conditions SC when receiving the content data set CDS, and then store the content data CD(s) into the content storage 35. Further,

15 the processing unit 31 discards any content data CD not satisfying the selection conditions SC. In this case, the processing unit 31 responds to the read request RS_{RO} from the DTE 1, and reads the content data CD that is selected at reception from the content storage 35 for transmission to the DTE 1. In this manner, the

20 user can acquire content data CD of interest only, and further, a efficient use of the recording area of the content storage 35 can be achieved since unwanted content data CD is not stored therein.

While the present invention has been described in detail, the foregoing description is in all aspects illustrative and not

25 restrictive. It is to be understood that numerous other

modifications and variations can be devised without departing from the scope of the present invention.